ROLE OF LITHIUM ION BATTERIES ($LiNi_YMn_YCo_{1-2Y}O_2$)IN SATISFYING THE ENERGY NEEDS OF FUTURE GENERATIONS

Light is everywhere,it allows to go about our daily activities and provides us with entertainment,security,technological advancements and healthcare,amongst other things.Discover the different roles light and its application play in our everyday lives.On the most fundamental level through photosynthesis,light is necessary to the existence of life.From sunsets to rainbow,from the blues and greens of the ocean to the remarkable range of colors of plant and animals,our first experience of light &color in the natural world.Solar energy will provide a practically inexhaustible resource that will enchance sustainability,reduce pollution and lower the cost of migrating climate change.The inter conversion of energy to make light from electricity,heat and chemical reactions in our daily life.we use chemistry and light communication,electronics,medicine and entertainment.

BATTERY:

A Battery is defined as a power-generating device which is able to convert stored chemical energy into work of an electrical nature.The stored energy is either inherently present in the chemical substances used as in the case of non-rechargeable and rechargeable battery.

Lithium is the lightest of metals and it floats on water.It also has a high electrochemical potential which makes it one of the most reactive of metals.These properties give Lithium,the potential to achieve very high energy and power densities in high power battery applications.

LITHIUM ION BATTERY(LIB):

LIBs are becoming a common replacement for the batteries that have been used historically for golf carts and utility vechicles.The commercial introduction of Lithium ion batteries about 15 years ago by Sony,$LiCoO_2$ has been the dominating cathode material.

This section summarizes six of the most common Li-ion.

- Lithium Cobalt Oxide($LiCoO_2$)
- Lithium Manganese Oxide ($LiMn_2O_4$)
- Lithium Nickel Manganese Cobalt Oxide($LiNiMnCoO_2$)
- Lithium Iron phosphate ($LiFePO_4$)
- Lithium Nickel Cobalt Aluminium Oxide($LiNiCoAlO_2$)
- Lithium Titanate($Li_4Ti_5O_{12}$)

DRAWBACKS OF $LiCoO_2$:

First used LIB is $LiCoO_2$,which offers high energy density at that time,latter it has been proved Li-Co is a relatively short life span,low thermal stability and limited load capabilities(specific power).Li-Co cannot be charged and discharged at current higher than its rating.This means that an 18650 cells with 2400mAh can only be charged and discharged at 2400mA.Forcing a fast charge or applying a load higher than 2400mA causes over heating.For optimal fast charge the manufacture recommends a C-rate of 0.8C or 1920mA.The mandatory battery protection circuits limits the charge and discharge rate to a safe level of about 1C.

Lithium Nickel Manganese Cobalt Oxide($LiNiMnCoO_2$):

Leading battery manufactures focus on a cathode combination of Ni,Mn,Co(NMC)similar to Li-Mn,these systems can be tailored to serve as energy cells or power cells.

NMC in an 18650 cell for moderate load condition has a capacity of about 2,800mAh and can deliver 4-5A.*NMC* in the same cell optimized for specific power has a capacity of only about 2,000mWh but delivers a continuous discharge current of 20A.A silicon based anode will go to 4000mAh but at reduced loading capability and shorter cycle life.

The secret of *NMC* lies in combining Ni and Mn. Ni is known for its high specific energy.Mn has the benefit of forming a Spinel Structure to achieve low internal resistance but offers a low Specific energy.Combining the metals enchances each other strengths.NMC is the battery of choice for power tools,e-bikes and other electric powertrains.Thecathode combination is typically 1/3Nickel 1/3 Mn1/3Co.This offers a unique blend that also lowers the raw material cost due to reduced cobalt content.Other combinations,such as NCM,CMN,CNM,MNC,andMCN are also offered.

WHY WE PREFORMING *NMC* AS CATHODE MATERIAL OTHER THAN $LiCoO_2$:

LMC Oxide positives with graphite negatives have a 3.7Vnominal voltage with a 4.2V maximum while charging. But for $LiCoO_2$is 3.3V-3.7V.In the past,LIBs($LiCoO_2$) could not be fast-charged and needed atleast 2hrs to fully charge.Current generationcells(NMC) can be fully charged in in 45 mins or less.

The low capacity discharge,$LiCoO_2$ goes to thermal decomposition.This instability is due to the reactive tetravalent Co in the delithiated state.Above $150^{®}$C such material collapses,which reaction is exothermic and the energy stored in the battery is released as

heat.During collapse,oxygen is released,which can combust the organic electrolyte and evolve more heat.(1,2)

So they have make research on improving the LIBs cathode materials. The NMC Batteries are come to use.

Cathode material –$LiMn_yNi_yCo_{(1-2y)}O_2$

Voltage, Normal	3.60V,4.70V
Specific Charge(Capacity)	150-220WH/kg
Charge (C-rate)	0.7-1C charges to 4.20Vto4.30V
Discharge rate(c-rate)	1C,2C possible on some cells,2.5V cut-off
Cycle life	1000-2000(related to the depth of discharge,temperature)
Thermal run way	210®C typical high charge promoters thermal runway.
Applications	e-bikes,medicaldevices,Evs,industrial provides high capacity and high power serves as Hybrid cell.
Types	$LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ $LiNi_{0.5}Mn_{0.5}O_2$ $LiNi_{0.4}Mn_{0.4}Co_{0.2}O_2$

Generally Allien metal ion Dopping can effectively improves the electrochemical properties.NMC OXIDE offer lower energy densitry but longer lives and inherent safety.such batteries are widely used for electric tools,Medical equipment.

ENVIRONMENTAL CONCERNS AND RECYCLING:

- Cobalt is very expensive,toxicity,dissolution of Co and its theoretical capacity is relatively low (130mAhg-1).When we add other materials with Co,the percentage of Co decreasing so their toxicity also decreases.
- Since Li-ion NMC batteries contains less toxic metals,they are generally categorized as non-hazardous waste LIBs elements including Fe,Cu,Ni,Co are considered safe for in cinerations and landfills.
- Li is flammable and highly reactive.Cobalt used in the creation of the most energy dense Li-ion batteries is poisonous and extremely carcinogenic,Pulmonary,Neurological and respiratory problems have all be connected to cobalt exposure.

CONCLUSION:

SAfter 50 years the coal and petroleum products will become demand for usage.A new era is going to appear that is electrochemical era or battery era.*The third world war may arise for Li metals* means also there is no surprise.These layered $LiNi_yMn_yCo_{1-2y}O_2$(NMC) with high crystallinity and homogeneity,which reduces the weight,shape,space of electronic devices.

NMC has good overall performanceand excerts on specific energy.This battery is the preffered candidate for the electric vehicle and has lowest self-heating rate.According to battery university,this battery is also commonly preferred for electric vechicles due to its very low self-heating.Recent Researches has discovered the LIBs in E-Bikes,E-Cars and Space Rockets and also producing 29.6V-51.8V in NMC($LiNiyMn_yCo_{1-2y}O_2$) for the Electrochemical performance indicates that these compound has a high Capacity,Cycliablity, Environment Protection and Smart Devices invention.

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